U. S. DEPARTMENT OF AGRICULTURE,

BUREAU OF SOILS—MILTON WHITNEY, Chief.

IN COOPERATION WITH THE UNIVERSITY OF NEBRASKA,
G. E. CONDRA, DIRECTOR, NEBRASKA SOIL SURVEY.

SOIL SURVEY OF BOX BUTTE COUNTY, NEBRASKA.

BY

F. A. HAYES, OF THE NEBRASKA SOIL SURVEY, IN CHARGE,
AND J. H. AGEE, OF THE U. S. DEPARTMENT
OF AGRICULTURE.

THOMAS D. RICE, INSPECTOR, NORTHERN DIVISION.

[Advance Sheets—Field Operations of the Bureau of Soils, 1916.]

WASHINGTON:
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1918.

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LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF SOILS,
Washington, D. C., October 9, 1917.

SIR: Under the cooperative agreement with the University of Nebraska a soil survey of Box Butte County was carried to completion during the field season of 1916. The selection of this area was made after a conference with State officials.

I have the honor to transmit herewith the manuscript and map covering this work and to recommend their publication as advance sheets of Field Operations of the Bureau of Soils for 1916, as authorized by law.

Respectfully,

MILTON WHITNEY,
Chief of Bureau.

Hon. D. F. HOUSTON,
Secretary of Agriculture.

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By F. A. HAYES, of the Nebraska Soil Survey, In Charge, and J. H. AGEE, of the U. S. Department of Agriculture.—Area Inspected by THOMAS D. RICE.

DESCRIPTION OF THE AREA.

Box Butte County lies near the northwestern corner of Nebraska. It is bounded on the north by Dawes County, on the east by Sheridan County, on the south by Morrill and Scotts Bluff Counties, and on the west by Sioux County. Dawes County separates it from South Dakota and Sioux County from Wyoming. The county is rectangular in outline, its dimensions being 36 miles east and west and 30 miles north and south. It has an area of 1,070 square miles, or 684,800 acres.

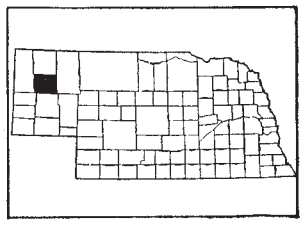

FIG. 1.—Sketch map showing location of the Box Butte County area, Nebraska.

Box Butte County lies in the High Plains division of the Great Plains region. It comprises a remnant of the ancient table-land sloping away from the Rocky Mountains. The surface formation consists of materials brought down from the elevated region to the west since the late Tertiary period and deposited as outwash debris by streams. The county has a southeastward slope, which is due partly to earth movements and partly to the natural slope of the constructional surface. The topography has been modified by both wind and water. Drainage channels have been established, and their valleys have been eroded and widened until very little of the original constructional surface remains.

Erosion has been especially active in the northern and northwestern parts of the county, where it has exposed the underlying formations along the drainage ways. A remnant of the ancient table that has escaped extensive erosion forms the high, level land near the center of the county.

The entire central part of the county, including the high tableland, is cut by parallel streams having a southeasterly course. These streams separate the table into long, narrow strips. The divides, however, are near the level of the original plain. On this high plain the surface varies from flat to gently undulating, with so little slope that were it not for the porous nature of the underlying rock and the low

rainfall, drainage would be deficient over much of its area. From the rim of this table-land the descent toward the streams is marked by a more rolling topography. Northward the land slopes toward the valley of the Niobrara. The slopes for a few miles are gradual, becoming steeper toward the river. In the northwestern part of the county this descent is more abrupt and marked by strips of eroded broken topography 1 mile to 3½ miles wide. The flood plain of the Niobrara River lies 100 to 150 feet below the level of the table. It extends in a narrow, irregular strip, varying in width from one-eighth to three-fourths mile, across the northwestern part of the county and parallels the northern boundary for approximately 8 miles.

North of the Niobrara River the land slopes southeastward. In the extreme northwestern corner of the county the descent is very rapid and is marked by a strip of rough, broken topography. Elsewhere north of the stream there is a more gradual slope. That part of the county west of the table and east almost to the county line, comprising about two-thirds of the area, is a rolling plain drained by numerous small, parallel streams. The valleys of these drainage ways are wide and shallow, but the flood plains are very narrow. The divides are gently to rather sharply rolling and consist of smooth, rounded hills and ridges.

The southern part of the county is traversed by Snake Creek. That this stream was once large and important is indicated by its broad valley and extensive terraces, the latter including both a lower or first terrace and a number of higher terraces. The upland on the north slopes very gradually toward the higher terraces. These terraces, or benches, are irregular in shape. Their widest points extend more than 5 miles north of the present channel of Snake Creek. The lower terrace along this stream lies 15 to 30 feet below the upper benches and 3 to 5 feet above the bed of the stream. The transition between the lower and upper terraces is a comparatively steep slope. The topography of both terraces is flat, though the lower bench is broken slightly in places by minor depressions, cut-offs, and old channels. A few lakes also occur, the largest of which is Bronco Lake. This body of water has an area of about 320 acres. It is fed by seepage, together with run-off from the uplands. It lies along the northern border of the lower terrace about 3 miles southwest of Alliance.

South of Snake Creek and along the south half of the eastern boundary of the county the topography presents two separate features. Immediately along the greater part of the southern and southeastern boundaries are narrow strips of Dunesand. These represent the western extension of the sand-hill region of north-central Ne-

braska. In this part of the county the typical dune topography has been developed over an area of about 36 square miles. North and east of the sand-hill area there is a strip varying in width from 2 to 5 miles, which has a more gently rolling topography.

Box Butte County has an average elevation of about 4,200 feet above sea level. It ranges from approximately 4,600 feet on the western border in the vicinity of Canton to about 3,850 feet at the termination of Snake Creek in the southeastern part. The elevation at Hemingford is 4,256 feet, and at Girard 4,365 feet. The general slope of the county is southeastward.

The largest stream in the county is the Niobrara River, which crosses the northwestern corner in a meandering course and continues in an almost easterly direction a few miles north of the county boundary. This stream drains somewhat less than one-fourth of the county. Its main channel varies in width from 20 to 30 feet, and it has a fall of about 13 feet to the mile. The steep slopes in the northwestern part of the county are drained toward the Niobrara River by small, intermittent streams.

In the north-central part of the county Dry Creek, a large, intermittent tributary of the Niobrara, follows a course nearly parallel to that stream for more than 15 miles. The east-central part of the county is drained by Box Butte Creek, another intermittent tributary of the Niobrara. This stream heads in the vicinity of Hemingford and flows eastward, crossing the county boundary about 1 mile northeast of Box Butte.

The central part of the county is drained by numerous intermittent streams, which follow a southeasterly course. Most of these streams flow into Snake Creek; some are absorbed in the porous sands of the eastern part of the county. Most of the eastern and southern parts of the county also are drained by Snake Creek. This stream has a rather sluggish flow, a very meandering channel, and dries up in prolonged periods of dry weather. The creek is building up its flood plain, especially where blocked by the sand hills. In addition to the Niobrara River, Snake Creek, and their larger tributaries, there are numerous intermittent streams which give adequate and complete drainage throughout the upland. On some of the steeper slopes the drainage is excessive. The extreme southern and southeastern parts of the county have no surface drainage. The surplus water, however, finds its way by seepage through the sand hills to the North Platte River.

Prior to 1885 the area now comprising Box Butte County was occupied by cattlemen who made use of the open range. The early settlers became aware of the possibilities of the region as a stock country during the rush to the gold fields in the Black Hills. The

county was formed from a part of Dawes County in 1886. It owes its name to Box Butte, a small promontory on the eastern boundary.

The population of Box Butte County, as reported by the census, increased from 5,572 in 1900 to 6,131 in 1910. It consists mainly of settlers from other parts of Nebraska. In 1910, 64 per cent of the inhabitants were native white of native parentage, about 24 per cent of native white of foreign or mixed parentage, about 11 per cent foreign-born white, and about 1 per cent negroes. Approximately 50 per cent of the population is classed as rural. The rural population is unevenly distributed, being densest in the vicinity of the city of Alliance and within and about the town of Hemingford. In 1910 it averaged 2.8 persons per square mile. The city of Alliance, the county seat, situated in the southeastern part of the county, includes all the population classed as urban. It is an important railroad point, and the railroad shops afford employment for many men. According to the 1910 census, Alliance has a population of 3,105 and Hemingford a population of 272. Hemingford is a shipping point of local importance.

Transportation facilities are good throughout the greater part of the county. The main line of the Chicago, Burlington & Quincy Railroad from Lincoln to Billings crosses the central part in a southeast-northwest direction. The towns of Alliance and Hemingford, and the sidings of Birdsell, Yale, Berea, Girard, and Nye are on this line. Another branch of this road extends southwestward from Alliance to Denver. Letan is on this branch line.

Most of the public roads, except in the sand-hill section and in the northwestern corner of the county, where the topography is rough, follow section lines. All of them are dirt roads. The more important highways are dragged as soon after each rain as the ground permits and are kept in a smooth condition. Little attention is given to the minor roads. In the sand hills the absence of building and surfacing materials, together with the uneven topography and small volume of traffic, make the establishment of fenced or permanent roads impracticable. Travel is laborious over the constantly shifting trails with gates on all property lines. Telephones and rural delivery routes reach nearly all sections of the county.

The surplus products, consisting principally of wheat, cattle, and potatoes, are marketed outside the county. Cattle are shipped to Omaha and Chicago. Wheat is sold chiefly in Omaha, though some is ground in the flour mill at Hemingford and sold in local markets. Nearly all the grain is handled at elevators in Alliance and Hemingford, where it may be sold at once or stored until the price is satisfactory. Potatoes are shipped to south-central and southern points, but the chief market is Kansas City. Most of the dairy products and eggs are sold in Alliance.

CLIMATE.

The climate of Box Butte County is characterized by wide extremes of temperature which is typical of the High Plains country and of regions situated at some distance from large bodies of water. The mean annual temperature, according to the records of the Weather Bureau station at Alliance, is 46.7° F. January and February are the coldest months, with a mean temperature of about 24°, and July and August the warmest, with a mean of about 71°. The lowest temperature recorded is —40°, in February, and the highest 105°, in June.

The precipitation consists mainly of local showers and is extremely variable. There is a mean annual rainfall of 16.39 inches, of which 70 to 75 per cent occurs during the growing season from the middle of April to the last of September. Half of this falls during the months of May, June, and July, with a maximum of nearly 3 inches in May. The normal precipitation for the driest months—November, December, January, and February—is about one-half inch per month. The rainfall in May and June is usually well distributed and droughts seldom occur in these months. In July the distribution is not so favorable. August and September combined have less rain than any one of the preceding three months. Occasionally long droughts occur in July, August, and September.

The average annual snowfall is slightly more than 30 inches, and two-thirds of this occurs in December, January, February, and March. The first light snow in the fall frequently falls in the latter part of September and the last flurry in the spring after May 1.

The average date of the first killing frost in the fall is September 28 and of the last in the spring, May 10. The date of the earliest recorded killing frost in the fall is September 12 and of the latest in the spring, May 27. There is an average growing season of about 141 days, which is long enough to mature the ordinary farm crops.

The prevailing direction of the wind is from the northwest. The winds are mainly from the south or southeast in June, July, and August, but from the middle of September to the middle of May they are generally from the northwest. Tornadoes are of rare occurrence. Extremely heavy and destructive rainfalls that may be classed as cloud-bursts have been known to occur.

The relative humidity is low. The average for the year is quite regularly near 70 per cent. It is frequently below 20 per cent in afternoons in the spring or summer, and in a few instances less than 10 per cent has been recorded. The sky is relatively clear. There is an average of 180 to 190 clear days and 60 to 70 cloudy days in the year, the remainder being partly cloudy.

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The following table is compiled from the records of the Weather Bureau station at Alliance:

Normal monthly, seasonal, and annual temperature and precipitation at Alliance.

Month.	Temperature.			Precipitation.		
	Mean.	Absolute maximum.	Absolute minimum.	Mean.	Total amount for the driest year.	Total amount for the wettest year.
	° F.	° F.	° F.	Inches.	Inches.	Inches.
December	26.7	70	−32	0.39	0.25	0.70
January	24.1	63	−35	.62	.43	.15
February	23.3	74	−40	.42	.55	T.
Winter	24.7	74	−40	1.43	1.23	.85
March	33.0	78	−20	.77	.88	1.30
April	46.2	87	8	1.98	.75	3.70
May	55.5	94	21	2.97	3.45	2.81
Spring	44.9	94	−20	5.72	5.08	7.81
June	66.0	105	32	2.83	1.30	3.88
July	71.6	104	36	2.69	1.85	1.01
August	71.0	103	36	1.80	1.70	3.75
Summer	69.5	105	32	7.32	4.85	8.64
September	61.2	101	17	.74	.00	1.32
October	49.9	91	8	.83	.50	3.30
November	34.3	80	−18	.35	T.	.95
Fall	47.8	101	−18	1.92	.50	5.57
Year	46.7	105	−40	16.39	11.66	22.87

AGRICULTURE.

Prior to 1885 Box Butte County was inhabited chiefly by cattlemen. During the years 1885, 1886, and 1887 the land was rapidly taken up by homesteaders and most of the cattlemen were forced out of the county. A few years of good crops occurred after this and immigration was greatly stimulated. Then followed some of the worst droughts the region has ever experienced, culminating in the extremely dry years of 1893 and 1894. Total failures of all crops resulted, and the new settlers, who were not experienced in farming in a subhumid region, suffered such great losses that they were compelled to leave the county in large numbers. A few of the settlers, however, seeing advantages in the stock industry, remained and acquired large tracts of land.

The following table giving the acreage and production of the principal crops of the county in 1889, 1899, and 1909, as compiled by

the census, shows the general trend of agriculture during the last 20 years:

Acreage and production of principal crops for 1889, 1899, and 1909.

Crop.	1889		1899		1909	
	Acres.	Yield.	Acres.	Yield.	Acres.	Yield.
		Bushels.		*Bushels.*		*Bushels.*
Corn	11,216	100,671	3,784	41,930	7,137	100,395
Oats	9,240	128,407	133	950	7,898	158,128
Wheat	6,446	63,285	944	4,950	7,869	94,226
Rye	532	4,071	100	830	1,415	15,548
Barley	549	5,194	11	130	1,713	29,549
Flaxseed	539	1,322	.....	.....	.....	.....
Potatoes	1,446	57,382	2,146	124,298	7,020	303,918
		Tons.		*Tons.*		*Tons.*
Hay and forage	17,102	17,005	28,975	24,431	46,024	28,843

Box Butte County lies in the short-grass country of the High Plains region, and stock raising is one of the chief sources of revenue. At the present time the agriculture of the county consists of the raising of cattle, horses, sheep, and hogs, in conjunction with general farming. The census of 1910 reports 23,822 cattle on farms and ranges and 10,327 sold or slaughtered. Of the former, 2,552 were milch cows, and of the animals sold or slaughtered, 1,080 were calves. The principal breeds of cattle are grade Herefords and Shorthorns. They are raised for market and for sale to eastern feeders. The cattle are shipped mainly to Omaha and Chicago. Very little grain is fed to the stock, and when not shipped in the fall the cattle are run on the range during the winter.

The 1910 census reports 7,667 horses on the farms and ranches in 1910. Several ranches have 20 to 60 horses. The horses are raised entirely upon pasturage and hay. They are mainly of draft types, ranging in weight from 1,100 to 1,300 pounds. The census reports 726 horses sold in 1909.

Hogs and sheep are not raised extensively. In 1909 there were 2,705 hogs and 3,227 sheep and goats sold or slaughtered.

Poultry raising is not practiced on a commercial scale. Most of the farms have small flocks of chickens, but few have a surplus of poultry products. The value of poultry and eggs produced in 1909 is reported by the census as $54,840. In 1910 domestic animals represented 15.1 per cent of the value of all farm property, as compared with 53.6 per cent reported in 1900 and 21.4 per cent in 1890.

A much larger acreage is devoted to wild hay than to any other crop in the county. The principal grasses are Stipa, sand grass, grama, buffalo grass, western wheat grass, and marsh grass. A

species of Stipa and a grass known locally as sand grass are cut on the sandy land, wheat grass on the heavier soils, and buffalo grass and grama are intermixed with all species. Marsh grasses are cut in the moist, low-lying areas. The greater part of the hay is fed on the farms and ranches to work stock and beef cattle.

The most important cultivated crops are oats, wheat, corn, and potatoes, ranking in the order named. Oats are grown throughout the county, the best yields being obtained on the heavier soils. Kherson and Swedish Select are the principal varieties. Most of the crop is used locally as feed for work stock.

Wheat is one of the principal money crops of the county. Most of it is grown on the heavier soils. Spring wheat is grown chiefly, durum being the principal type. Turkey Red is the leading variety of winter wheat. A part of the wheat is used locally, but most of the crop is shipped to Omaha and Chicago.

Corn is grown on many of the farms. Early varieties, including Native White Cap, Blue and White Squaw, Small Yellow Dent, and Small Calico Dent are grown. All the corn grown in the county is used on the farms for feeding stock. The general practice is to cut most of the crop for fodder or ensilage. The use of silos is becoming more common.

Box Butte is one of the foremost potato counties in Nebraska, both as to quality and quantity of the product. Potatoes are the chief money crop of the county, and are grown on practically every farm. The principal varieties are the Early Ohio, Bliss Triumph, and White Eureka. The Early Ohio is grown quite generally over the county, while the Bliss Triumph is grown mainly on the heavy silt soils of the table-land, and the White Eureka on the sandy soil of the Valentine series in the eastern part of the county. The potatoes are shipped to southern and south-central markets. The Bliss Triumph is grown chiefly for the southern seed trade.

The adaptation of soils to crops receives but little attention, and practically all the general farm crops common to the region are grown on most of the soil types. It is recognized, however, that the Rosebud and Dunlap silt loams and the Rosebud very fine sandy loam are well suited to the production of wheat, oats, corn, and potatoes, although the last-named type is more subject to drifting than the others. The Valentine loamy fine sand is recognized as a good soil for white potatoes, but is too light textured for the production of wheat. The shallow phases of the Rosebud very fine sandy loam and loamy fine sand, as well as the Rough broken land and Dunesand, are considered best adapted to grazing and the production of hay.

The farm buildings vary widely in cost and kind of construction. The more prosperous farms usually have modern frame buildings,

which are kept in good repair, but over the greater part of the county the improvements are not so good, many of the dwellings being built of sod or consisting of small, unpainted wooden structures typical of a newly settled country. The improvements as a whole, however, are probably as good as those of any county in western Nebraska. A noticeable feature of most farms is that the barns are greatly out of proportion to the houses both in size and cost. This is probably due to the fact that the region is primarily a stock country and large buildings are necessary for the shelter of cattle and horses. Most of the fences are of barbed wire. The work stock consists of draft horses of medium weight. The farm machinery includes 2-horse and 4-horse turning plows, listers, spike-tooth harrows, seed drills, cultivators, mowing machines, rakes, binders, and wagons. A few of the larger farms have tractor outfits. Machines for thrashing small grain travel about the county, serving the farmers soon after harvest. In growing small grains the fields are plowed but once in 3 or 4 years. The stubble ground is double disked as soon as possible after the snow has gone in the spring and the land is in condition to work, which is usually about the middle of April. The seed is generally sown with a drill. Winter wheat is sown about September 1 in plowed stubble land and harvested about July 15. Corn is usually planted on stubble ground. It is listed in, as this promotes the conservation of moisture. Both corn and oats are often planted on sod land. In growing potatoes on the silty soils the land is plowed as early in the spring as possible, and the seed planted at the rate of 5 to 8 bushels per acre, between May 15 and the latter part of June, with a single-row, 1-man planter. The hills vary from 12 to 22 inches apart in the rows, and the rows are 3 to 3½ feet apart. On the sandy soil of the Valentine series a sort of lister is used directly on old ground without plowing and the seed is planted between the lister ridges, the soil being less likely to blow when prepared in this manner. Potatoes are cultivated three or four times in a season, a one-row corn cultivator being used. Harvesting, which starts about October 1, is generally done with a 4-horse or 6-horse elevating digger. The crop is either hauled to market or stored in pits until harvesting is finished.

No definite system of rotation is followed. Grain fields are generally kept in the same crop year after year. In changing from corn to wheat, oats are generally used as an intermediate crop, though wheat is often drilled in between the corn rows. Potatoes usually follow small grains.

No commercial fertilizer and very little manure is used. The plowing under of green crops is not practiced.

There is usually a scarcity of labor during the busy season in the summer. Grain harvesting and haying are carried on about the

same time and more hands or usually needed than are available. The wages range from $2 to $3 a day, with board. Most of the help is obtained from farms on which work is not pressing and from the towns, where there are many men familiar with farm work. The greater part of the work is done by the farmers and their families, especially in harvesting the potato crop.

According to the census, there were 588 farms in the county in 1910, as compared with 484 in 1900 and 1,083 in 1890, and the average size of the farms was 930.6 acres in 1910, 758 acres in 1900, and 210.8 acres in 1890. The farms vary in size from 160 acres to several sections. In 1910 the census reports 79.5 per cent of the total area of the county in farms and 15.2 per cent of the farm land improved. Owners operated 82.7 per cent of the farms and tenants practically all the remainder. Most of the land operated by tenants is rented by the owners of adjoining land and used for grazing. The rent is usually about $80 a section, the owner paying the taxes. The price of land varies according to improvements, topography, and location with respect to towns and transportation facilities. Over the greater part of the county it ranges from $12 to $25 an acre. The 1910 census reports the average assessed value as $12.40 per acre.

SOILS.

On the basis of the origin of the soil material, the soils of Box Butte County may be grouped in four main divisions: (1) Residual soils, or those derived in place by weathering from the underlying formation, (2) alluvial, or stream-deposited, soils, (3) eolian, or wind-blown, soils, and (4) miscellaneous materials.

The principal soil-forming rock in Box Butte County is the Arikaree sandstone, which underlies this part of the Great Plains and outcrops in places. This formation is of Teritary age and belongs to the Loup Fork beds. It is a sedimentary deposit, and as a whole is fine grained and fairly resistant to erosion. In its unweathered state it consists of gray sands and soft, sandy, calcareous shales and sandstones, which weather into a group of gray soils ranging in texture from loamy fine sand to heavy silt loam. A characteristic feature of these soils is the finely divided, white, calcareous material that occurs in the subsoil and frequently outcrops over large areas in the more hilly sections. The residual soils of the uplands are derived mainly from the Arikaree formation.

The alluvial soils occupy high terraces, low terraces, and poorly drained flood plains. They comprise materials that have been washed down from the weathered soils of the Arikaree formation on the adjoining uplands and from the more elevated regions to the west

and deposited along the main streams of the county. The basal material consists of fine sand, very fine sand, and silt. The sand is composed largely of quartz and feldspar.

The high terraces north of Snake Creek and along Box Butte Creek represent the oldest alluvial deposit in the county. They comprise beds of silt and very fine sand which have been subjected to weathering for a considerable time. The lower terraces occurring along both sides of Snake Creek are formed of more recent deposits, consisting mainly of very fine sand, but containing in places a large quantity of silt. They lie 3 to 5 feet above the stream channel and are for the most part well drained.

The first bottoms, or flood plains, are of recent origin and in many places are still in process of formation. They occur along Snake Creek and the Niobrara River and lie from 1 to 3 feet above the surface of the streams. The first bottoms as a rule are poorly drained, especially those along Snake Creek, which occur as shallow depressions either close to the stream channel or scattered upon the low terrace.

The eolian, or wind-blown, soils are composed of materials from both residual and alluvial areas. Strong winds have probably always characterized the climate of the Great Plains and have played an important part in the assorting and distributing of materials brought down by the streams. The work of the wind in disintegrating the Arikaree formation and in transporting the soil materials in recent geological times and even at the present time is very obvious in this county. It is the most active agent of soil transportation, and there is only a comparatively small percentage of the county which has not been modified to some extent by the addition of wind-blown materials. The eolian soils are distributed chiefly through the southern and eastern parts of the county. They consist of materials ranging from gray sands to grayish-brown loamy fine sands.

The characteristic soil profile of the High Plains is well developed in all the soils of the county except those whose material has been accumulated so recently that sufficient time for its development has not yet elapsed. It is developed on all the areas of smooth land, including the terraces, except those parts covered deeply by recent accumulations of wind-blown material. The profile consists of a dark-brown surface layer with a well-defined grayish shade, the layer varying in thickness with the texture as well as with the topography and ranging from 4 inches to nearly 2 feet. It is thinner on the light-textured types and on all types occurring on steep slopes. On the flat areas it is thickest and the lower part of the horizon has developed into a heavy clay layer approaching a clay hardpan. The latter

soils are mapped as Dunlap. The second horizon in the profile consists of a highly calcareous layer which may or may not be somewhat compact, though in no case has it become cemented into a hardpan. It ranges from about 1 foot to nearly 2 feet in thickness. The third member in the profile consists of light-colored material, less calcareous than the second. This is the profile marking the mature stage of development in the soils of the Rosebud, Dunlap, and Tripp series. The soils not yet old enough to have developed this profile are grouped in the Laurel, Scott, and Valentine series.

In the classification adopted by the Bureau of Soils the soils are grouped into series on the basis of similarity in color, structure, origin, mode of formation, topography, and drainage. The soil series is divided into soil types, on the basis of texture, which depends upon the proportion of mineral particles of different sizes. The type is the unit of mapping.

The residual soils of the county are classed with the Rosebud and Dunlap series; the alluvial, or stream-deposited, soils with the Tripp, Yale, Laurel, and Scott series; and the eolian, or wind-blown, soils in the Valentine series. The miscellaneous materials are mapped as Dunesand, Meadow, and Rough broken land.

The surface soils of the Rosebud series are dark gray to brown; the subsoils are light colored and very calcareous. A characteristic feature of this series is the light-gray to almost white color of the deeper subsoil. These soils are derived from the light-colored, very calcareous, unconsolidated Tertiary deposits of the High Plains, mainly from sandstone, limestone, and shale rocks. The topography ranges from undulating to steeply rolling, and in places the surface is excessively eroded or dissected, forming areas of Rough broken land. This series is represented in Box Butte County by four types, the loamy fine sand, fine sandy loam, very fine sandy loam, and silt loam.

The Dunlap series includes brown to dark-brown surface soils, 6 to 12 inches deep, underlain by a dark-brown, compact, heavy, silt loam. This passes gradually through a light-brown or light grayish brown, heavy silt loam into light-gray to almost white, floury, calcareous silt loam. The soils of this series occupy the flat tops of the high tables representing remnants of the original High Plains, and the topography ranges from almost flat to undulating. The material has been derived through weathering under conditions of restricted drainage from the fine-grained, calcareous sandstones of the Arikaree formation. These soils differ from those of the Rosebud series in their heavy, compact subsoils and more nearly level topography. Only one member of this series, the silt loam, is mapped in Box Butte County.

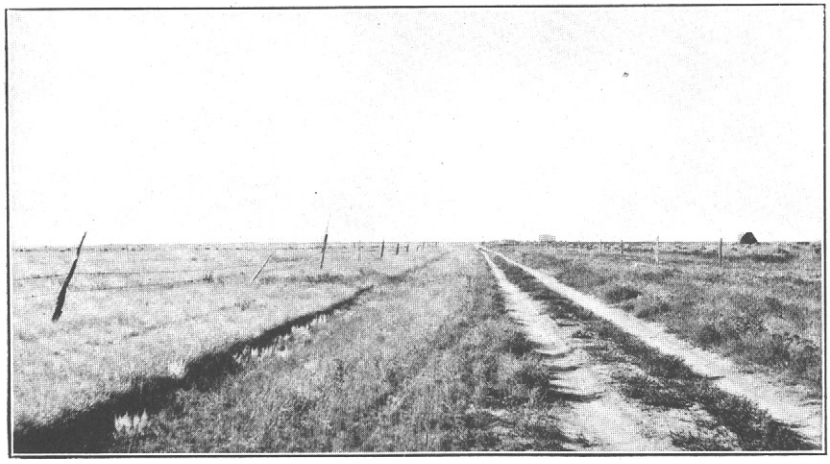

FIG. 1.—CHARACTERISTIC LEVEL TOPOGRAPHY OF THE TABLE-LAND.

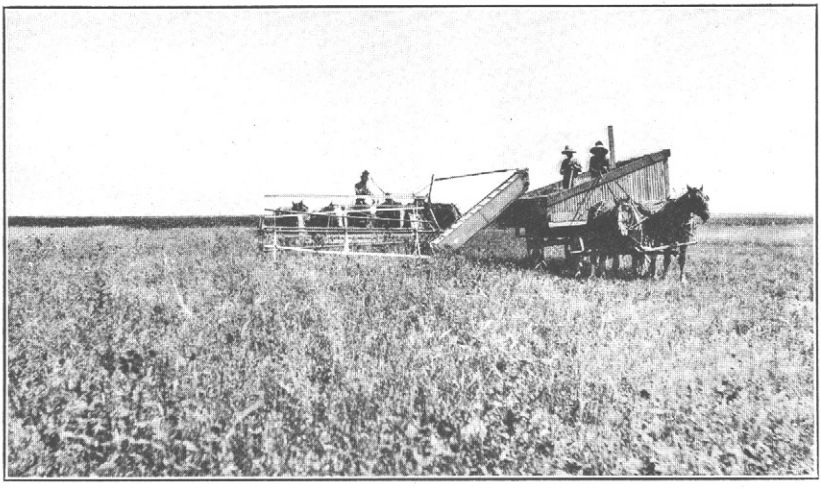

FIG. 2.—CUTTING WHEAT ON THE HIGH TABLE-LAND.

The Tripp series includes grayish-brown to brown soils, underlain by gray to grayish-brown subsoils. The subsoils are generally calcareous and are similar in texture to the surface soils. These soils occur on high terraces and are well drained. One type, the very fine sandy loam, is recognized in Box Butte County.

The soils of the Yale series are grayish brown to brown in color and 6 to 12 inches deep. The subsoil consists of a light-brown, compact silt loam or silty clay loam, which has a hardpan structure and is 8 to 12 inches thick, overlying a light-gray or light yellowish brown silt loam. The soil and upper subsoil are only moderately calcareous, but the lower subsoil has a high lime content. These soils occupy old terraces high above overflow. Although the topography is flat, the drainage is adequate, owing to the small amount of rainfall. The soils of this series differ from those of the Tripp series only in the compact structure of the upper subsoil. Two types, the very fine sandy loam and silt loam, are mapped.

The soils of the Laurel series are light gray to light brown and are underlain by yellowish-gray to dark-gray, calcareous subsoils. These soils occupy first-bottom positions along the Niobrara River and Snake Creek and, as a rule, are poorly drained. They differ from the soils of the Tripp series chiefly in topographic position and drainage. Two types, the fine sandy loam and silt loam, represent the series in Box Butte County.

The Scott series is represented in this county by the silt loam, calcareous-hardpan phase. This is a dark-gray to black, fairly compact silt loam, about 6 inches deep, underlain by a light-gray to almost white silt loam which contains an abundance of small lime concretions. The phase occupies a depression in the High Plains where a thin layer of sediment has been deposited probably in standing water.

The Valentine series includes grayish-brown to brown soils, underlain by gray to yellowish-brown, noncalcareous subsoils. These soils occur chiefly in the southern and eastern parts of the county. They are composed of wind-transported material from both the bottom lands and the weathered Arikaree formation of the uplands. One type, the loamy fine sand, is mapped.

Dunesand includes areas of almost pure sand having a dunelike topography and subject to drifting.

Meadow consists of small areas of mud flats and low, marshy slopes where the material is so variable that it can not be separated into types.

Rough broken land includes areas too rough and broken for cultivation.

Areas of different soils.

Soil.	Acres.	Per cent.	Soil.	Acres.	Per cent.
Rosebud very fine sandy loam	164,672	34.2	Yale silt loam	11,712	1.7
Shallow phase	69,696		Yale very fine sandy loam	6,784	1.0
Rosebud silt loam	136,768	20.0	Laurel silt loam	6,592	1.0
Valentine loamy fine sand	84,480	12.3	Rough broken land	5,568	.8
Dunlap silt loam	66,752	9.8	Meadow	3,904	.6
Rosebud loamy fine sand	45,440	7.9	Laurel fine sandy loam	2,048	.3
Shallow phase	8,384		Scott silt loam, calcareous-hardpan phase	1,536	.2
Dunesand	25,408	3.7			
Tripp very fine sandy loam	22,912	3.3	Total	684,800	
Rosebud fine sandy loam	22,144	3.2			

ROSEBUD LOAMY FINE SAND.

The Rosebud loamy fine sand consists of a dark-gray to grayish-brown loamy fine sand, 6 to 12 inches deep, with an average depth of about 8 inches, changing gradually to a light-brown or light grayish brown, calcareous loamy fine sand to fine sand, which extends to a depth of 3 feet or more. Both soil and subsoil are deficient in organic matter. In texture and structure this soil is intermediate between the Valentine loamy fine sand and the Rosebud fine sandy loam. It is less coherent and more subject to wind erosion than the latter type.

This type is most extensive in the southwestern and southern parts of the county. It occurs in large, irregular areas on both sides of Snake Creek. Smaller areas lie in the northwestern and southeastern parts of the county.

The topography ranges from slightly rolling to hilly and broken, the greater part of the type being too rolling to be well adapted to agriculture. While there are few streams in this type, it is well drained, owing to its porous nature.

Very little of the Rosebud loamy fine sand is cultivated, as it is subject to drifting when plowed. It is used mainly as pasture and hay land, for which it is well suited. The rough topography affords shelter for stock during storms.

The Rosebud loamy fine sand may be distinguished from the Rosebud fine sandy loam by differences in vegetation. The principal native grasses are Stipa, or needle grass, buffalo grass, grama, and black root, the first named predominating. There is also some sagebrush.

Stipa affords good pasturage during the spring season. By the middle of June the sharp awns or seeds of this grass become objectionable and the cattle prefer other grasses. By the first week in July the awns are generally ripe, and before the end of the month the greater part of them have either been blown away or have fallen off

the stems. The hay is then cut before the stems become dry. The yield ranges from one-fourth to one-half ton per acre. Black root, grama, and buffalo grass supply winter pasturage. The type is capable of supporting 30 to 40 head of cattle per section throughout the year. In severe winter weather hay is fed to the stock.

The price of land of the Rosebud loamy fine sand ranges from $5 to $15 an acre, depending upon improvements.

Rosebud loamy fine sand, shallow phase.—The Rosebud loamy fine sand, shallow phase, consists of a dark-gray to light grayish brown loamy fine sand. In places where the surface has been protected from blowing the soil changes at about 8 inches to a light grayish brown loamy fine sand to fine sand. Like the shallow phase of the Rosebud very fine sandy loam, this phase is underlain at shallow depths by the white, calcareous Arikaree formation. The rock is nowhere more than 3 feet below the surface and over the greater part of the phase it is exposed in places, giving the soil a spotted appearance.

This phase occurs in scattered bodies over all the county except the central part. Its principal occurrence is in the northwestern corner, south of the Niobrara River. There are some small bodies within areas of the typical Rosebud loamy fine sand in the southwestern part of the county.

In the northern part of the county, where the phase is dissected by streams leading to the Niobrara River, the surface is gullied and hilly, though not broken. In other sections, where the soil is more subject to erosion by wind, the topography is rolling to hummocky. In places, including Wild Horse Butte and Box Butte, the phase occupies elevated areas where the sweep of the wind is unchecked.

The entire phase is excessively drained, owing to the porous nature of the soil and subsoil.

Because of the nearness of the underlying rock to the surface and the liability of the soil to wind erosion, this phase is unsuited to cultivation. It is used almost exclusively for pasture. As in the case of the shallow phase of the Rosebud very fine sandy loam the topography affords protection for stock during severe weather. The native vegetation differs but little from that on the typical Rosebud loamy fine sand, though it is not so luxuriant. Yucca, or bear grass, grows in some of the more exposed areas. The phase is capable of supporting 25 to 35 head of cattle per section the year round.

The price of land of this phase ranges from $5 to $15 an acre, depending mainly upon improvements.

ROSEBUD FINE SANDY LOAM.

The surface soil of the Rosebud fine sandy loam consists of a grayish-brown to brown, loose, friable fine sandy loam, with an average depth of about 12 inches. The upper 6 inches of the sur-

face soil contains considerable organic matter and has a slightly darker color than the lower part. The subsoil usually differs but little in texture from the surface material, but is lighter in color, ranging from pale yellow to light gray. In many places it changes to a silt loam or very fine sandy loam at a depth of about 24 inches. The lower subsoil has a very high content of lime.

The Rosebud fine sandy loam is comparatively inextensive. It is developed mainly in irregular strips along the northern border of the county, within the Niobrara Valley. Other strips are encountered in the northeastern and southeastern parts of the county. Some small areas are surrounded by the Rosebud very fine sandy loam.

The topography ranges from gently undulating to hilly, by far the greater part of the type being gently rolling. The small, scattered bodies within areas of the Rosebud very fine sandy loam consist of low, smooth hills or ridges standing slightly above the general level of that type. Along the northern county line, north and west of Hemingford, where there are numerous small drainage ways, the topography is rolling to hilly. It is nowhere rugged, however. The drainage is good and in most cases excessive. Owing to the porous nature of the soil and subsoil, many of the small drainage ways disappear before reaching the Niobrara River to the north.

Only a very small part of this type is cultivated. By far the greater part of it, including the areas along the northern boundary of the county, is used as grazing land. The native vegetation varies according to the quantity of sand in the soil. Over the heavier, more nearly level areas black root, buffalo grass, and grama predominate, and in the sandier areas bordering the Valentine soils Stipa, or needle grass, is most common. The cultivated crops and the yields are similar to those on the adjoining types.

The price of the Rosebud fine sandy loam ranges from $8 to $15 an acre, depending upon the topography and improvements.

By adopting a system of cultivation that would not keep the surface soil of this type too well pulverized, it is possible that fair yields of most crops could be obtained. In the more nearly level areas, where not too sandy, crops should withstand drought better than on the Rosebud silt loam.

The following table gives the results of the mechanical analyses of samples of the soil and subsoil of the Rosebud fine sandy loam:

Mechanical analyses of Rosebud fine sandy loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
372123	Soil	0.2	0.4	1.2	65.6	15.8	13.0	3.7
372124	Subsoil	.6	.4	1.0	72.4	12.6	8.9	3.9

ROSEBUD VERY FINE SANDY LOAM.

The surface soil of the Rosebud very fine sandy loam is a brown to grayish-brown very fine sandy loam, 10 to 18 inches deep, with an average depth of about 12 inches. It is underlain by a light-brown to light grayish brown very fine sandy loam, which changes at a depth of 18 to 30 inches to a light-gray to gray silty loam or very fine sandy loam. Owing to a higher content of organic matter, the surface 6 inches usually is darker colored than the remainder of the soil section. The surface soil usually contains a large percentage of silt, but not so much as the upper subsoil. In places the upper subsoil is slightly compact. The lower subsoil contains much finely divided, white, calcareous material. In some areas it consists of white, calcareous, silty material, resembling the lower subsoil of the Rosebud silt loam.

This type occurs in irregular areas throughout the uplands. There is one very extensive and uniform area in the northeastern part of the county and another large but less uniform body in the southwestern part, north of Snake Creek. An area several square miles in extent is mapped in the southwestern corner of the county, south of Snake Creek.

The Rosebud very fine sandy loam, like the Rosebud silt loam, has a flat to gently rolling topography and is traversed by intermittent streams flowing in a southeasterly direction. The stream valleys, however, are not so wide and smooth as those in the silt loam type. The drainage is good, and in a few places excessive. Much of the rainfall percolates through the porous soil and subsoil. In the area in the northeastern part of the county the stream channels are so poorly defined that it is difficult to trace them.

Only a very small percentage of this type is under cultivation. Most of it is used as pasture land. The native vegetation differs little from that of the Rosebud silt loam. In addition to the common grasses found on the latter type, there are a few that thrive on more sandy soils, including needle grass and sand grasses. In the southwestern part of the county, south of Snake Creek, the type supports a growth of sagebrush.

The principal crops are corn, oats, wheat, and potatoes. Cattle are kept on the range throughout the year, but most of the stock is shipped in the fall after being taken off the summer pasture. Dairying is not carried on very extensively, although practically every farmer has some dairy products to sell.

The same methods of cultivation are followed on this type as on the Rosebud silt loam, and the yields are similar to those obtained on the heavier soils. Corn yields ordinarily about 20 bushels of grain or from 1 to $3\frac{1}{2}$ tons of fodder per acre; wheat and rye, 8 to 25 bushels; Irish potatoes, 50 to 150 bushels; and oats, 10 to 30 bushels.

The price of land of the Rosebud very fine sandy loam ranges from $8 to $20 or more an acre, depending upon improvements and distance from markets.

While this type is naturally more retentive of moisture than the heavier soils of the county, it is not advisable to keep the surface soil too well pulverized, because of the danger of drifting.

Rosebud very fine sandy loam, shallow phase.—The Rosebud very fine sandy loam, shallow phase, consists of a brown to dark-brown very fine sandy loam to silt loam. In the more nearly level areas where erosion has not been very active, the soil changes at a depth of 8 to 12 inches to a light-brown or light-gray very fine sandy loam. The underlying white, calcareous rock of the Arikaree formation is nowhere more than 3 feet below the surface, and over the greater part of the phase there are frequent exposures, giving the surface a spotted appearance.

This phase is extensive and is found in all parts of the county except the southeastern. The largest areas occur on the slopes of the Niobrara Valley and other large areas lie along Dry Creek. The phase occupies the sharply cut stream valleys where erosion has left large areas of the rock exposed or with only a very shallow covering. The drainage as a rule is excessive.

Owing to the nearness of the bedrock to the surface and the liability of the soil to erosion, this phase is unsuited to cultivation. It is used c iefly as pasture land. The rough topography affords protection for stock during severe weather. The native vegetation consists of grama, buffalo grass, wheat grass, and black root. The phase is capable of supporting 30 to 40 head of cattle per section throughout the year.

Land of this phase sells for $5 to $15 an acre, depending on the topography and improvements.

The following table gives the results of the mechanical analyses of samples of the soil, subsoil, and lower subsoil of the typical Rosebud very fine sandy loam:

Mechanical analyses of Rosebud very fine sandy loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
372120	Soil	0.2	2.4	4.4	41.2	22.2	24.6	5.0
372121	Subsoil	.1	2.6	4.9	47.4	19.4	15.5	9.9
372122	Lower subsoil	.4	3.4	5.2	52.3	17.0	10.8	10.9

ROSEBUD SILT LOAM.

The surface soil of the Rosebud silt loam, to an average depth of about 12 inches, consists of a grayish-brown to brown silt loam con-

taining varying quantities of very fine sand. The depth and color of the soil vary with the stage of weathering and the amount of organic matter present. The surface 6 inches usually is high in organic matter. The subsoil consists of a light-brown or light grayish brown silt loam, somewhat compact in places and changing gradually to a light-gray to almost white, floury material. The subsoil is calcareous throughout, and the white material in the lower part is largely composed of lime. In places there are fragments of limestone or calcareous sandstone in the lower subsoil. The partially weathered Arikaree formation underlies the entire type at a depth of 4 to 6 feet.

The Rosebud silt loam is the second most extensive soil type in the county. It occurs throughout the residual part of the uplands, the largest areas occupying the gradual slopes around the high, flat table-land in the central part of the county. The topography ranges from almost flat to gently rolling. By far the greater part of the type occupies smooth, undulating plains. The most rolling areas lie in the eroded belts along stream channels.

The type is traversed by parallel intermittent streams with rather deep but narrow channels, and surface drainage is good throughout. The porous subsoil and substratum insure good underdrainage.

Only a small proportion of this type is under cultivation, but the total area of cultivated land is almost as large as that of any other type in the county. The uncultivated areas support a heavy growth of native grasses, of which grama, buffalo grass, wire grass, and black root are the most common. They are used for pasture and the production of hay. The poisonous loco is occasionally encountered. The principal cultivated crops are wheat, corn, barley, and potatoes. The last-named crop is not grown so extensively as on the higher table-land, although the soil is well suited to it. The greater part of the type is included in stock farms and ranches on which beef cattle are grazed. A small herd of horses is kept on nearly every ranch. Very few dairy cattle are kept. The type supports 40 to 50 head of cattle per section the year round.

Corn yields 10 to 40 bushels of grain or 1 to 4 tons of fodder per acre; wheat 8 to 30 bushels; Irish potatoes 50 to 150 bushels; oats 10 to 45 bushels; rye 10 to 30 bushels; and barley about the same as oats. Native grasses yield one-fourth to 1 ton of hay per acre. The higher yields mentioned are exceptional.

The Rosebud silt loam, when properly managed, is easily kept in good tilth, and is a good soil for dry farming. Under present methods of cultivation the soil retains sufficient moisture to insure good crops except in seasons of prolonged drought. When plowed wet it has a slight tendency to clod, but the clods are easily reduced. No definite rotation is followed, as the land is new and in no imme-

diate danger of becoming exhausted. The small grains usually are drilled in on old stubble or corn land. Corn usually follows small grains. It is generally listed in, as the ground conserves the moisture better than where surface planted. The grain is often planted on sod land.

The price of land of this type ranges from $8 to $25 an acre, depending mainly upon its location with respect to roads and markets. The lowest price applies to the remote sections and is based almost entirely upon the value of the land for hay production and pasture.

The Rosebud silt loam is naturally a very strong soil, and its productiveness could be greatly increased by the use of cultural methods designed to conserve moisture. More thorough preparation of the seed bed for small grains is advisable even at the expense of a reduction of the acreage. For corn and other tilled crops the maintenance of a surface mulch by frequent cultivation is necessary.

DUNLAP SILT LOAM.

The surface soil of the Dunlap silt loam, to an average depth of about 12 inches, consists of a brown to dark-brown, mellow, friable silt loam, with a high content of organic matter. It is slightly more compact than the surface soil of the Rosebud silt loam. The upper 4 to 10 inches of the subsoil consists of a dark-brown, compact, heavy silt loam. This passes gradually into a light-brown or light grayish brown, heavy silt loam, which changes at a depth of 24 to 30 inches to a light-gray to almost white calcareous, silty material. In places the material below a depth of about 34 inches consists of fine or very fine sand. Fragments of calcareous sandstone of the Arikaree formation are frequently encountered in the lower subsoil, and the entire type is underlain by this material at depths ranging from 3 to 6 feet.

The Dunlap silt loam occupies several large, irregular areas lying mainly near the center of the county. The largest area extends south and southwest from Hemingford, and is broken only by stream channels with narrow strips of other types. Areas of this soil extend to the edge of the breaks along the Niobrara Valley in the northwestern part of the county.

This type occupies the almost level remnant of the high plains, and has been subjected to very little erosion. The surface varies from almost flat to gently undulating, with a gradual slope toward the southeast. The parallel streams of this section have cut rather deep valleys, but local drainage channels have not been extended into the old plain surface. The drainage is effected in part by broad swales and in part through the porous substratum. There is rarely sufficient rainfall to cause water to stand on the surface.

The Dunlap silt loam is one of the most productive soils in the county. The greater part of it, however, is in pasture. The native

vegetation consists of western wheat grass, grama, black root, and buffalo grass. The wheat grass is by far the most important. In places the poisonous loco is encountered. The principal crops are wheat and potatoes. Corn, barley, and alfalfa are grown to a small extent.

Spring wheat yields 8 to 30 bushels per acre, and winter wheat slightly more. Corn yields 10 to 40 bushels of grain or 1 to 5 tons of fodder, oats and barley 10 to 45 bushels, and rye 10 to 30 bushels per acre. Potatoes seem to do better on this type than on any other soil in the county, yields ranging from 50 to 200 bushels per acre, with an average of about 100 bushels. Alfalfa yields about 1 ton per acre. The same methods of cultivation are followed on this type as on the Rosebud silt loam.

The price of land ranges from $15 to $30 an acre, depending on improvements and the distance from market.

With proper care the Dunlap silt loam could be made the most valuable farming soil in the county. The heavy subsurface material is retentive of moisture.

The following table gives the results of the mechanical analyses of samples of the soil and subsoil of the Dunlap silt loam:

Mechanical analyses of Dunlap silt loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
372125	Soil	0.0	0.8	1.4	15.0	37.3	34.0	11.0
372126	Subsoil	.1	.4	1.2	12.4	30.0	32.0	23.6

TRIPP VERY FINE SANDY LOAM.

The surface soil of the Tripp very fine sandy loam, to an average depth of about 10 inches, consists of a grayish-brown to brown very fine sandy loam. It is generally loose and friable, though slightly compact in places. The surface 6 inches is high in organic matter and slightly darker in color than the remainder of the soil. The subsoil consists of a gray to grayish-brown very fine sandy loam to silt loam or sandy clay, which changes at a depth of about 24 inches to a light-gray or gray very fine sand. The subsoil is generally calcareous, and both soil and subsoil contain varying quantities of soluble salts, though not enough to be injurious to crops.

Included with this type in the southwestern part of the county are a few small areas in which the surface soil to an average depth of about 10 inches consists of a brown to a light-brown silt loam containing considerable very fine sand. This is underlain by a light-gray to gray silt loam or silty clay loam which in many places

changes to very fine sandy loam at a depth of 24 inches. These areas are not separated on the map, because of their small extent.

The Tripp very fine sandy loam occupies an almost continuous strip along Snake Creek and represents the remnants of an old terrace. The widest part of this strip is south of Alliance. The topography is almost flat, but owing to the sandy nature of the soil and its slight elevation above the stream bed, drainage is fairly good.

Only a relatively small part of this type is under cultivation, most of it being used as pasture and hay land. The largest body of improved land lies just east of Elmore Dam, where a small local irrigation project supplies water for approximately 2,000 acres.

The principal crops are alfalfa, native hay, and potatoes. The irrigated land is used chiefly for the production of hay. Some corn is grown, mainly for fodder. Alfalfa yields 2 to 3 tons per acre from three cuttings on the irrigated land, prairie hay 1 ton to 1½ tons, and potatoes 100 to 250 bushels. On the unirrigated land alfalfa yields about 1 ton per acre per season, prairie hay one-third to 1 ton, and potatoes 50 to 150 bushels. This type is capable of supporting 30 to 40 head of cattle per section.

The price of land of this type ranges from $7 to $50 an acre, depending upon location and improvements.

The Tripp very fine sandy loam is naturally strong, and with proper handling can be made one of the most productive soils in the county.

The following table gives the results of the mechanical analyses of samples of the soil, subsoil, and lower subsoil of the Tripp very fine sandy loam:

Mechanical analyses of Tripp very fine sandy loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
372105	Soil	0.0	2.2	3.1	21.3	43.0	22.4	7.6
372106	Subsoil	.1	2.8	4.4	28.2	34.7	12.0	17.5
372107	Lower subsoil	.1	5.3	8.1	42.2	29.0	5.7	9.0

YALE VERY FINE SANDY LOAM.

The surface soil of the Yale very fine sandy loam, to a depth of 8 to 12 inches, is a grayish-brown to brown, loose, friable very fine sandy loam. The upper 6 inches of the material is slightly darker than the remainder owing to a higher content of organic matter. The upper subsoil consists of a somewhat lighter colored fine sandy loam, passing through a dark grayish brown to dark-brown, compact silt loam to very fine sandy loam into a gray to almost white, highly calcareous silt loam to very fine sandy loam.

The Yale very fine sandy loam is very inextensive. It occurs in several areas along the larger streams in the eastern part of the county. Typical areas also lie near Alliance and on Box Butte Creek, near the eastern county boundary. Like the Yale silt loam, this type occupies high terraces. The surface is relatively flat, with a gentle slope toward the south and southeast. Drainage is good, owing to the elevated position of the type and the porous nature of the substratum.

The native vegetation consists mainly of wheat grass, grama, and buffalo grass. A large part of the type is included in stock farms and ranches, and is used mainly as pasture and hay land. Where cultivated the same crops are grown as on the Yale silt loam, and there is little difference in yields. The type is naturally more retentive of moisture than the Yale silt loam.

The selling price of this land ranges from $15 to $35 an acre, depending upon improvements and nearness to market.

In cultivating the Yale very fine sandy loam it is not advisable to keep the surface soil too well pulverized, on account of its tendency to drift.

The following table gives the results of the mechanical analyses of samples of the soil and subsoil of the Yale very fine sandy loam:

Mechanical analyses of Yale very fine sandy loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
372118	Soil	0.0	0.4	0.9	29.2	40.7	23.0	5.6
372119	Subsoil	.0	.3	.9	36.6	31.4	21.3	9.5

YALE SILT LOAM.

The surface soil of the Yale silt loam, to a depth of 10 to 12 inches, consists of a light-brown to brown, mellow silt loam containing varying quantities of very fine sand. This passes abruptly into a rather compact, light yellowish brown to grayish-brown silt loam, which changes at a depth of 20 to 24 inches to a light-gray or grayish-yellow silt loam. The soil and upper subsoil have a low content of lime, while the lower subsoil is highly calcareous. At a depth of 3 to 6 feet, as shown by borings and excavations, the type is underlain by a bed of waterworn gravel.

The Yale silt loam occurs in several areas in the southeastern part of the county. The largest area lies directly east of Alliance, and a part of the city is located on it. Another large body lies about 5 miles northeast of Alliance.

The type occupies high terraces, and the surface is almost flat, with a gentle slope toward the south and southeast. Owing to the elevated position of these terraces, the drainage is fairly good.

Because of its small extent, this type is not very important agriculturally, although a large part of it is under cultivation. The native vegetation consists of wheat grass, grama, and black root. The crops common to the region, including wheat, corn, potatoes, oats, and alfalfa, are produced. Dairying is practiced on a few farms. Beef cattle are grazed over the greater part of the type. A section will support 35 to 40 head of cattle. The yields on this type are about the same as on the Dunlap silt loam.

The price of this land ranges from $15 to $50 an acre, depending upon improvements and the distance from Alliance.

The Yale silt loam is inherently fertile, and, as is the case with most of the soils of the county, the low yields are due entirely to a lack of moisture. They can be increased by employing cultural methods that will conserve moisture.

The following table gives the results of mechanical analyses of samples of the soil and subsoil of the Yale silt loam:

Mechanical analyses of Yale silt loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
372116	Soil	0.1	1.4	2.0	12.6	37.2	32.9	13.3
372117	Subsoil	.0	.6	.6	4.6	37.0	40.4	16.7

LAUREL FINE SANDY LOAM.

The Laurel fine sandy loam, to an average depth of about 14 inches, consists of a light-brown to gray, loose fine sandy loam, underlain by a gray or yellowish-gray fine sandy loam, mottled in the lower part with brown or drab. The upper 8 inches of the surface soil is high in organic matter. The subsoil, especially the lower part, is deficient in organic matter. Both soil and subsoil are highly calcareous. Included with this type are some small areas in which the lower subsoil and substratum contain considerable coarse sand and small gravel.

This type occurs in a continuous strip, varying in width from one-eighth to three-fourths of a mile along the Niobrara River. The topography is almost flat and the land near the stream is rather poorly drained and subject to overflows.

The Laurel fine sandy loam is inextensive, and only a small percentage of it is under cultivation. It is used chiefly as pasture and hay land. The native vegetation consists mainly of grama, western

wheat grass, and wire grass. Along the river banks, especially where the northern tributaries enter the stream, there is a sparse growth of cottonwood and willows. The type is capable of supporting 30 to 40 head of cattle per section. Alfalfa has been successfully grown in places. Native grasses yield one-half to 1 ton of hay per acre. Only a small quantity of corn is grown.

The price of land of this type ranges from $15 to $25 an acre, depending on drainage and improvements.

This type is best suited to the production of hay, as it drifts when cultivated. Alfalfa could probably be grown with greater profit than prairie hay.

LAUREL SILT LOAM.

The surface soil of the Laurel silt loam to a depth of 8 to 12 inches is a light-gray to gray silt loam containing varying quantities of very fine sand. The subsoil consists of a gray to dark-gray silt loam to very fine sandy loam, changing at a depth of about 24 inches to a light-gray to gray silt loam to very fine sand. Sometimes the immediate surface soil is almost black, owing to a high content of organic matter. The subsoil is generally deficient in organic matter, though highly calcareous.

In places the subsoil is more compact than usual between 12 and 24 inches. Most of the type contains soluble salts, but not enough to be harmful to crops. Along Snake Creek, about 2½ miles east of Elmore Dam, there is a narrow strip in which the surface soil approaches a very fine sandy loam.

The Laurel silt loam occurs in several areas along the Snake Creek bottoms. The topography is flat and the drainage is poor. Water stands on much of the type during a large part of the year.

Owing to its small extent and poor drainage, this type is unimportant. Practically none of it is under cultivation, and it is used almost exclusively for pasture and the production of hay. The native vegetation consists of horsetail, rushes, sedges, and nutritious marsh grasses. Hay yields 1 ton to 1½ tons per acre. The hay produced on this soil is coarser and less valuable than that grown on the adjoining uplands. The type is capable of supporting 40 to 50 head of cattle throughout the year on the native grasses.

The price of land of this type ranges from $10 to $25 an acre, depending mainly on its location.

The Laurel silt loam is naturally a strong soil, and if properly drained should prove one of the most productive types in the county.

SCOTT SILT LOAM, CALCAREOUS-HARDPAN PHASE.

The Scott silt loam, calcareous-hardpan phase, consists of a dark-gray to black, fairly compact silt loam, changing rather abruptly at

a depth of about 6 inches to a light-gray to almost white silt loam which contains an abundance of small lime concretions. The surface soil is high in organic matter. It is sticky when wet and tends to become cloddy upon drying. Owing to the large percentage of lime concretions in the subsoil, it is impossible to bore deeper than 8 or 10 inches with a soil auger.

This phase is very inextensive. The largest area, which is approximately 2½ miles long and three-fourths mile wide, lies about 5 miles west of Hemingford. It occupies a basinlike depression, where a thin layer of sediment has been deposited, probably in standing water. The topography is almost flat, and there is no surface drainage, but the porous substratum affords sufficient underdrainage, except in seasons of excessive rainfall.

This phase is unimportant agriculturally and is used exclusively as pasture and hay land. The native vegetation consists principally of grama and buffalo grass. Acreage yields of one-half to three-fourths ton of hay are obtained.

The price of this land ranges from $15 to $25 an acre.

VALENTINE LOAMY FINE SAND.

The Valentine loamy fine sand consists of grayish-brown to brown, loose, friable loamy fine sand, 8 to 12 inches deep, underlain by a fairly compact, though friable fine sand, which changes at a depth of about 18 inches to a loose, incoherent, light yellowish brown fine sand. Both soil and subsoil are deficient in organic matter and are noncalcareous.

This type occurs in the southern and eastern parts of the county, where it lies between areas of Dunesand and the soils of the Rosebud series. One area occurs near the northwest corner of the county. The largest and most uniform body lies along the southern boundary, south of Snake Creek. Another large area extends north from Birdsell Siding along the eastern boundary line for a distance of about 14 miles. Small areas occur within the Rosebud types.

The type occupies depressed areas along the valleys at the foot of the sand hills. The topography is level to gently undulating, and is broken by small ridges and knolls composed of sand brought down from the dunes. There is no surface run-off, the rainfall, sinking into the porous sand and flowing away through subterranean channels.

The Valentine loamy fine sand has about the same agricultural value as the Rosebud loamy fine sand. It is subject to drifting when cultivated, and for this reason most of it is used as pasture and hay land. Small areas are cultivated in depressions and valleys where crops can get moisture through seepage. The native vegetation con-

sists of needle grass, black root, and grama, with some loco. Needle grass, a species of Stipa, is by far the most important. There is some sagebrush on this type in the southeastern part of the county.

Hay is the most important crop. The principal cultivated crops are potatoes and corn. Corn yields 10 to 35 bushels, potatoes 50 to 150 bushels, and hay one-fourth to three-fourths ton per acre, depending upon the rainfall. The type is capable of supporting 25 to 35 head of cattle per section. The most popular variety of potatoes grown on this type is the White Eureka, or Flat Cobbler. The potato crop is planted somewhat earlier than on the heavier soils. The seed is placed between lister ridges on old corn or wheat land.

The price of the Valentine loamy fine sand ranges from $5 to $20 an acre, depending upon improvements and nearness to market.

In cultivating this type great care must be taken to keep the soil from drifting. It is advisable to plant corn and potatoes between lister ridges and to cultivate no more than is necessary to control the weeds.

DUNESAND.

Dunesand consists of gray to yellowish-gray or brownish-gray, smooth, incoherent, fine to medium sand, which extends to a depth of more than 3 feet with little change in texture. The soil contains some organic matter, but not enough to prevent drifting when the covering of grasses is removed. It is unusually retentive of moisture, considering its loose structure. Neither the soil nor the subsoil is calcareous.

This type is confined to irregular strips near the eastern and southern boundaries of the county.

The monotonous topography of Dunesand is due to wind action. The surface is sharply rolling, ridged, and heaped into dunes varying from 30 to 100 feet in height. Steep slopes abound. Numerous small hummocks, hollows, and blow-outs vary the otherwise billowy appearance of the landscape. The blow-outs are most common on the northwest faces of the dunes. A negligible part of the type is subject to active wind erosion.

There are no continuous waterways through the type, but owing to the loose, porous nature of the substratum all the rainfall is absorbed.

Dunesand is of no value for farming. It is used almost exclusively as pasture land, though some hay is cut in the smoother areas. The native vegetation includes a great number of grasses, of which long-leafed reed grass, Redfieldia, and Stipa are the most common. During the spring and summer these grasses afford good grazing, but in the winter they are killed by frost and can not be depended upon.

The type, with its hay production, is capable of maintaining 30 to 35 head of stock to the section.

The price of Dunesand ranges from $8 to $12 an acre, depending upon improvements.

MEADOW.

Meadow comprises small areas of mud flats and low, marshy slopes. The soil materials range in texture from coarse gravel to silty clay, and are so thoroughly intermixed that a separation into types is impracticable. Both the soil and subsoil are calcareous. The surface 6 inches has a high content of organic matter, but the subsoil is generally deficient in this material.

The areas of Meadow are scattered over the southern and southeastern parts of the county, and generally lie within or adjoining soils of the Valentine series. The topography is flat. There is no surface drainage and the subdrainage is generally inadequate. Water stands on the type in places during a part of the year.

Owing to its small extent and poorly drained condition, Meadow has very little agricultural value. It is used exclusively as hay and pasture land, generally in conjunction with soils of the Valentine series.

The native vegetation consists of sedges, reeds, and nutritious marsh grasses. Hay is cut from the better drained areas, yields of three-fourths ton to 1 ton per acre being obtained. The hay is coarser and of less value than that produced on the adjoining soil types.

The price of Meadow ranges from $7 to $20 an acre, depending upon location and drainage.

ROUGH BROKEN LAND.

Rough broken land includes areas that are too rough and broken for cultivation. It is confined mostly to the northern and northwestern parts of the county. The largest area is in the northwestern part, occurring as a narrow rim around the heads of several drainage ways that flow into the Niobrara River. Small areas lie along Dry Creek. The areas vary from sharply rolling, stony land to bare, dissected escarpments. Drainage is excessive and erosion active.

Rough broken land is used only for grazing. It is valued at $8 to $12 an acre, depending upon the topography.

SUMMARY.

Box Butte County is located in the northwestern corner of Nebraska. It embraces an area of 1,070 square miles, or 684,800 acres.

The topography ranges from almost flat to rough and extremely dissected. The county lies in the High Plains division of the Great

Plains region, and the topography has resulted from erosion by both wind and water.

The elevation of the county above sea level ranges from about 3,850 feet in the southeastern corner to 4,600 feet on the western boundary in the vicinity of Canton. The average elevation is approximately 4,200 feet above sea level.

The county is drained by the Niobrara River and Snake Creek, with their tributaries, and also by underground seepage through the sand hills to the North Platte River. Nearly every part of the county is well drained.

The earliest settlers came principally from other sections of Nebraska. The county was formed in 1886 from a part of Dawes County. The population is given in the 1910 census as 6,131. Alliance, the county seat, located in the southeastern corner of the county, is the largest town. It had a population of 3,105 in 1910.

The county has fair transportation facilities, being served by two lines of the Chicago, Burlington & Quincy Railroad. Most of the wagon roads are in good condition the greater part of the year.

The climate is semiarid, and is characterized by extremes of temperature. The mean annual temperature is 46.7° F., and the mean annual precipitation 16.39 inches. Occasionally long droughts occur. There is a normal growing season of about 141 days.

Box Butte County lies in the short-grass country of the High Plains region, and stock raising is one of the chief sources of revenue. Beef cattle are raised both for market and for eastern feeders. Horses are raised on many farms. The stock is grazed on the range almost exclusively, and very little grain is fed. The work stock consists of medium-weight draft horses.

The principal crops are hay, oats, wheat, corn, and potatoes. Wheat and potatoes are the principal money crops.

In 1910 there were 588 farms in the county of an average size of 930.6 acres. Over the greater part of the county the price of land ranges from $12 to $25 an acre.

The Arikaree sandstone is the principal soil-forming rock in Box Butte County, and most of the soils are sandy. Exclusive of the miscellaneous materials, mapped as Dunesand, Meadow, and Rough broken land, 12 soil types, one of which is represented only by a phase, are recognized in Box Butte County. These are classed with 7 soil series.

The Rosebud series, including four types, occupies the gently rolling to hilly country around the rim of the high table in the center of the county. The Rosebud very fine sandy loam and silt loam, the most valuable types of this series, are used for grazing and for the production of all farm crops adapted to the region. The Rosebud

loamy fine sand and fine sandy loam are used chiefly for grazing and hay production, while their shallow phases are used almost exclusively for grazing.

The Dunlap series is represented by a single type, the silt loam, which occupies the flat, undissected table-land in the central part of the county. This is one of the most valuable soils in the county, and is suited to the production of all the farm crops common to the region. Wheat and potatoes are produced most extensively.

In the Yale series two types are mapped, the very fine sandy loam and silt loam. These are old alluvial soils and occupy high terraces, mostly in the northeastern part of the county. They are the most densely populated types in the county, owing to their flat topography and nearness to the city of Alliance. The same crops are grown on these soils as on the Dunlap silt loam.

The Tripp series is represented by one type, the very fine sandy loam, which occupies the lower terrace along Snake Creek. A small part of this type is under irrigation and produces wild hay, alfalfa, and potatoes. Most of the unirrigated part of it is used as hay and pasture land.

The Laurel series, embracing two types, the fine sandy loam and silt loam, occupies first bottoms and poorly drained positions on low terraces. These soils are used chiefly as pasture and hay land.

The Scott series is represented by the silt loam, calcareous-hardpan phase. This phase is inextensive and occupies basinlike depressions where water has probably stood. It is used exclusively as pasture and hay land.

The Valentine series, represented by a single type, the loamy fine sand, is composed of wind-blown material, and occurs chiefly in the eastern and southern parts of the county. Irish potatoes are grown to some extent on this type, but most of it is used as pasture and hay land.

Dunesand includes areas of almost pure sand, having a dunelike topography, Rough broken land includes areas that are too rough and broken to permit of cultivation, and Meadow consists of small areas of mud flats and low, marshy slopes that are so lacking in uniformity as to make a separation into types impracticable.

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[PUBLIC RESOLUTION—No. 9.]

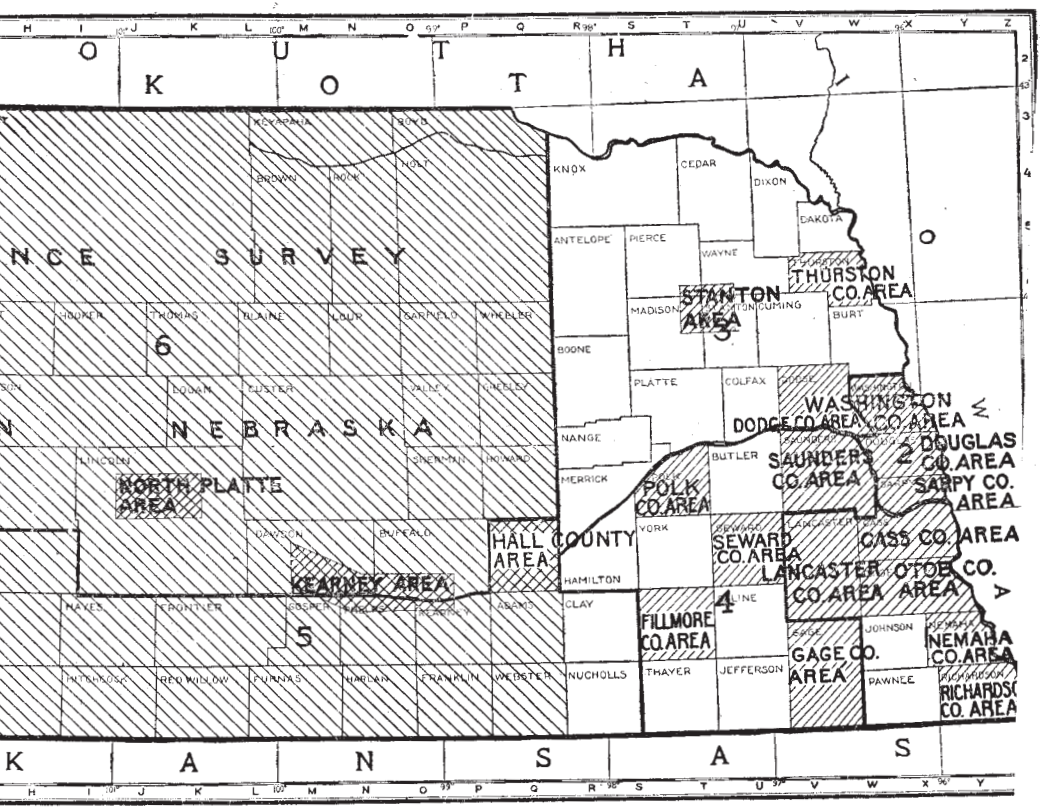
JOINT RESOLUTION Amending public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, "providing for the printing annually of the report on field operations of the Division of Soils, Department of Agriculture."

Resolved by the Senate and House of Representatives of the United States of America in Congress assembled, That public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, be amended by striking out all after the resolving clause and inserting in lieu thereof the following:

That there shall be printed ten thousand five hundred copies of the report on field operations of the Division of Soils, Department of Agriculture, of which one thousand five hundred copies shall be for the use of the Senate, three thousand copies for the use of the House of Representatives, and six thousand copies for the use of the Department of Agriculture: *Provided,* That in addition to the number of copies above provided for there shall be printed, as soon as the manuscript can be prepared, with the necessary maps and illustrations to accompany it, a report on each area surveyed, in the form of advance sheets, bound in paper covers, of which five hundred copies shall be for the use of each Senator from the State, two thousand copies for the use of each Representative for the Congressional district or districts in which the survey is made, and one thousand copies for the use of the Department of Agriculture.

Approved, March 14, 1904.

[On July 1, 1901, the Division of Soils was reorganized as the Bureau of Soils.]



Areas surveyed in Nebraska.

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U. S. DEPT. OF AGRICULTURE
BUREAU OF SOILS
MILTON WHITNEY, CHIEF
CURTIS F. MARBUT, IN CHARGE SOIL SURVEY

SOIL MAP
NEBRASKA,
BOX BUTTE COUNTY SHEET

UNIVERSITY OF NEBRASKA
G.E. CONDRA, DIRECTOR
NEBRASKA SOIL SURVEY

LEGEND

- Rosebud loamy fine sand (Ro)
- Yale very fine sandy loam (Yl)
- Yale silt loam (Ys)
- Shallow phase (Rr)
- Rosebud fine sandy loam (Rl)
- Tripp very fine sandy loam (Tr)
- Rosebud very fine sandy loam (Rf)
- Dunlap silt loam (Da)
- Scott silt loam Caliche-underlain-hard pan phase (S)
- Shallow phase (Sr)
- Rosebud silt loam (Rs)
- Larned silt loam (La)
- Valentine loamy fine sand (V)
- Larned fine sandy loam (Ll)
- Meadow (M)
- Rough broken land (R)
- Dunesand (D)

CONVENTIONAL SIGNS

CULTURE
(Printed in black)

City or Village Roads, Buildings Wharves, Jetties, Breakwater, Levee, Lighthouse, Fort
Secondary roads and Trails
Railroads Steam and Electric
Bridges Ferry
R.R. crossings Tunnel
Ford Dam
School or Church Cemeteries
Mine or Quarry Mine dumps Made land
Bluff, Escarpment, Rock outcrop and Triangulation station
Stony and Gravelly areas
Soil boundaries
Boundary lines
Boundary lines
Boundary lines
U.S. township and section lines

RELIEF
(Printed in brown or black)

Contours Depression contours
Prominent Hills Mountain Peaks
Sand Wash and Sand dunes
Shore and Low water line Sandbar

DRAINAGE
(Printed in blue)

Streams
Lakes Ponds Intermittent lakes
Intermittent Streams
Springs Canals and Ditches Flumes
Swamp Salt marshes
Submerged marsh Tidal flats

The above signs are in addition to those on the maps Hereafter from the usage appear in some maps of earlier date

Thomas D. Rice, Inspector, Northern Division
Soils surveyed by F.A. Hayes, of the Nebraska Soil Survey, in Charge,
and J.H. Agee of the U.S. Department of Agriculture

J. Bien & Co. Lith. Rahway, N.J.

Field Operations
Bureau of Soils
1915